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GENERAL NOTES.

The *Astronomische Nachrichten*, No. 4101, contains a plan for a Durchmusterung of variable stars proposed by Professor SOLON I. BAILEY and presented by Professor E. C. PICKERING. The plan involves the examination of all stars of the sixteenth magnitude or brighter (estimated at fifty millions in number). The instrumental equipment suggested involves only an eight-inch photographic telescope of the doublet type, with the possible addition of a stereocomparator to aid in the comparison of plates. It is contemplated that amateurs and observatories of modest instrumental equipment should take a prominent part in this work, which would occupy the attention of variable-star observers for a generation.

The plan is simply to make several photographs of a particular region of the sky at intervals covering a period of several months, and, by a comparison of the plates, pick out the stars that show evidence of variability.

Particular attention is called to the value of negative results which establish the fact that any portion of the sky is lacking in variable stars.

Stereoscopic Determinations of Proper Motion.—The stereocomparator was ushered into the astronomical world at the meeting of the Astronomische Gesellschaft in Göttingen in the summer of 1902, where it was placed on exhibition and aroused general interest. It is described in No. 94 of these *Publications*, p. 22. One of these instruments forms part of the equipment of the Astrophysical Institute at Heidelberg, and the Director, Professor MAX WOLF, announces in No. 4101 of the *Astronomische Nachrichten* some interesting results obtained with its help. He finds that slight relative differences in the positions of star-images on two photographic plates can be measured with great accuracy. These changes of position may be due to any one of several causes, or to a combination of them. Most important of these causes are proper motion of some of the stars, and differential refraction effects, due to differences in the color of the stars. The ease with which displacements of a few seconds of arc can be detected, as

well as the accuracy with which they can be measured, combine to make this instrument one of remarkable promise. Professor WOLF'S results indicate the possibility of measuring relative displacements with an accuracy of less than a second of arc on plates made with a lens of about thirty-two inches' focal length. Differences in the color (i. e. spectral characteristics) betray themselves by the displacements due to differential refraction, or by a comparison of plates made with lenses of equal focal length, but corrected for different wave-lengths, when the exposure is made at considerable zenith-distance.

The application of the stereoscopic principle promises to play an important role in future astronomical investigation. Its chief and obvious advantage lies in the striking manner in which relative displacements amounting to a hundredth of a millimeter or more are brought out, rendering their detection possible without a laborious process of measurement and reduction. Whether the accuracy of the photographic method will be materially increased by the application of this principle remains to be seen.

B. L. N.

The following notes have been taken from recent numbers of *Science*:—

Columbia University is to have a six-inch equatorial, suitable for student work. The glass has been presented by Mrs. WILDE, and completely refined and refigured by Messrs. Alvan Clark's Sons, of Cambridgeport.

At the meeting of the council of the Royal Astronomical Society held on June 1st the following resolution was unanimously agreed to: "That the council learn with deep concern of the danger threatened to the Royal Observatory, Greenwich, from the erection of a large electric-generating station near the observatory, and desire to represent to the Admiralty at the earliest possible opportunity their conviction of the paramount importance of maintaining the integrity and efficiency of Greenwich Observatory which has been adopted as the reference-point for the whole world."

Professor SIMON NEWCOMB has been elected a member of the board of overseers of Harvard College.

The death is announced of M. RAYET, director of the observatory and professor in the University of Bordeaux.

The following extracts have been taken from an account in the *London Times* of the report of the Astronomer Royal to the board of visitors of the Royal Observatory, Greenwich:

"The astrographic equatorial has been chiefly used for making new chart plates, some of those previously passed being unsuitable for photographic reproduction. Eighty-three chart plates were taken during the year, thirty-five of *Jupiter* and surrounding stars, two of *Mars* and surrounding stars. The Astrographic Catalogue is nearing completion, the zones from 64 to 84 north declination having now been printed, leaving only six more degrees to finish it. It will contain about 178,000 stars; seven times as many as the most extensive catalogue of the region hitherto in existence—viz., the Bonn Durchmusterung. The chart will contain nearly four times as many stars as the catalogue; it is being pushed on rapidly, 12,000 prints, reproducing 191 plates, having been taken during the year; 401 plates, about one third of the whole, have now been reproduced. The reproductions are on bromide cards, twice the linear scale of the plates, and are distributed to about fifty institutions, including the leading observatories.

"The 30-inch reflector has been used for the photography of *Jupiter's* new satellites, comets, and minor planets; eighty-six photographs were obtained of satellite VI, which is of the fourteenth magnitude, and nineteen of satellite VII, which is of the sixteenth magnitude. As far as is known these are the only photographs of satellite VII obtained elsewhere than at the Lick Observatory, and they will be of use in improving the determination of its orbit. The orbits of the two satellites are nearly equal in size, the periods of revolution being 251 days and 257 days, implying distances of about seven millions of miles from *Jupiter*. Both orbits are eccentric and inclined about thirty degrees to *Jupiter's* orbit, though their planes of motion are quite different. It was at first thought that they might go round *Jupiter* in a retrograde direction, like *Phoebe*, *Saturn's* ninth satellite, but this has now been disproved. One of the more interesting comets photographed has been that discovered by KOPFF at Heidelberg last March. It has an immense perihelion distance, three and one third times as great as the Earth's distance from the Sun, and had passed perihelion five months before discovery. The photographs show a much more definite outline than is commonly the case with comets.

"Mr. COWELL has concluded the analysis of all the Greenwich observations of the Moon since 1750, which was in progress at the date of the last report. Values have been deduced for the coefficients of all the solar perturbations and compared with the theoretical values found by HANSEN and BROWN, the agreement in most cases being very satisfactory. Mr. COWELL finds evidence for the existence of three empirical terms, two being small ones with periods of about half a century, the third a large term with a period of over three centuries. The necessity for a term of this character had been already

pointed out by Professor NEWCOMB, but Mr. COWELL has altered the period and the coefficient. The search for a physical explanation of this large term has so far been in vain, and it is at present one of the outstanding mysteries of gravitational astronomy. The presence of this term makes it impossible to deduce the secular acceleration of the Moon from modern observation, and Mr. COWELL has re-examined the ancient eclipses of the Sun and Moon with a view to its determination. He has selected six solar eclipses, of which the records appear fairly definite and satisfactory, the earliest being one in B. C. 1063, recently discovered by Mr. KING, of the British Museum, in a Babylonian inscription. On the hypothesis that the Moon has an acceleration of eleven seconds per century, and the Sun one of four seconds, it was found possible to represent satisfactorily all the above solar eclipses, besides several of the lunar eclipses recorded by PROLEMY. There are thus considerable grounds for accepting the above accelerations. The acceleration of the Sun was at first rather perplexing, as it appeared contrary to gravitational theory, unless the supposition was made that the Earth was moving in a resisting medium. But a more probable explanation has recently been arrived at—namely, that the acceleration is only apparent and is due to a retardation of the Earth's rotation by tidal friction, and a consequent lengthening of the day. Now, in all his computations the day, not the year, has been taken as the unit of time, and consequently a lengthening of that unit would produce an apparent acceleration in the motion of all the heavenly bodies. Of the eleven seconds found for the lunar acceleration, six seconds are known to be due to the diminution in the eccentricity of the Earth's orbit, leaving five seconds to be accounted for by tidal friction. At first sight this would appear to imply a solar acceleration only one twelfth as great, or practically insensible. But, by the principle of the conservation of angular momentum, a retardation of the Earth's rotation involves an increase in the Moon's distance, and a consequent lengthening of her period. This effect would mask the greater part of the apparent acceleration due to the lengthening day, so that the observed amount for the Moon is quite consistent with a solar acceleration of several seconds. This principle had been enunciated by Sir GEORGE DARWIN twenty-five years ago in his researches on the birth of satellites by tidal evolution; but the necessity of applying such a correction to the actual observations of the Moon had been strangely overlooked till the present time. It must be admitted that the descriptions of the ancient eclipses are not quite so definite as could be desired, but the agreement of six of them undoubtedly gives considerable weight to the result, according to which the day is lengthening by one two-hundredth of a second in a century.

"The solar activity in 1905 was pronounced, being double that for 1904; as 1906 has so far shown a falling off, the sun-spot *maximum* appears to be over. Arrangements have been made for taking enlarged photographs of interesting spot groups on a scale of thirty inches to the Sun's diameter, with the 26-inch photographic refractor. The

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sun-spot photographs taken between 1874 and 1885, re-enforced by photographs taken at Harvard and Melbourne, have now been measured, and the results printed, thus making a continuous series from 1874 to the present time. In spite of the great sun-spot activity in 1905, there were no days of great magnetic disturbance, and only twelve of lesser disturbance.

"The Astronomer Royal alludes in his report to the anxiety caused by the opening of the new generating station at Greenwich, which is half a mile due north of the observatory. It is feared that smoke and heated air may affect the observations of low north stars, and there is evidence that the vibration caused by the engines produces sensible tremors in the mercury trough used for reflection observations of the nadir and of stars.

"The staff has suffered the loss of Mr. F. W. DYSON, who was appointed Astronomer Royal for Scotland on the death of Dr. COPELAND. Mr. A. S. EDDINGTON, scholar of Trinity College, Cambridge, and Senior Wrangler in 1904, has been appointed to fill his place."
